Peer Reviewed, Open Access, Free
Published Quarterly
Mangalore, South India
ISSN 0972-5997
Volume 7, Issue 2; Apr-Jun 2008

Original Article

Effect of use of socially marketed faucet fitted earthen vessel/sodium hypochlorite solution on diarrhea prevention at household level in rural India

Authors

AR Dongre, PR Deshmukh, BS Garg,
Dr Sushila Nayar School of Public Health,
Mahatma Gandhi Institute of Medical Sciences,
Sewagram – 442102, India

Address For Correspondence

Pradeep Deshmukh,
Professor, Dr. Sushila Nayar School of Public Health,,
Mahatma Gandhi institute of Medical Sciences, Sewagram
Wardha (India), 442 102.
E-mail: prdeshmukh@gmail.com

Citation

Dongre AR, Deshmukh PR, Garg BS. Effect of use of socially marketed faucet fitted earthen vessel/sodium hypochlorite solution on diarrhea prevention at household level in rural India. *Online J Health Allied Scs.* 2008;7(2):1

URL

http://www.ojhas.org/issue26/2008-2-1.htm

Submitted: April 25, 2008; Accepted: June 19, 2008; Published: July 21, 2008

Abstract:

Objective: To evaluate the effect of socially marketed faucet fitted to earthen vessel / sodium hypochlorite solution on diarrhea prevention at rural household level as a social intervention for diarrhea prevention under 'Community Led Initiatives for Child Survival (CLICS) program. **Methods:** Unmatched case-control study was carried out in 10 villages of Primary Health Centre, Anji, located in rural central India. During the study period, 144 households used either faucet fitted earthen vessel to store drinking water or used sodium hypochlorite solution (SH) for keeping drinking water safe. These served as case households for the present study. 213 neighborhood control households from same locality who used neither of the methods were also selected. **Results:** Odds ratio for households who used faucets fitted to earthen vessel was 0.49 (95% CI= 0.25 – 0.95). Odds ratio for households who used sodium hypochlorite solution was 0.55 (95% CI= 0.31 – 0.98). Use of these methods by the community, would prevent about 27 percent and 22 percent cases of the diarrhea (Population attributable risk proportion = 0.25 by faucets fitted to earthen vessels and 0.22 by use of sodium hypochlorite solution) respectively. **Conclusion:** To ensure safe drinking water at household level, the effective and cheap methods like fitting faucet to traditionally used earthen vessel and/or use of sodium hypochlorite solution must be promoted through community participation at household level for cost and culture sensitive rural people in India.

Key Words: Community participation, Diarrhea prevention, Faucet, Hypochlorite solution, Earthen vessel, Social marketing

Introduction:

In Maharashtra state of India, 68 percent of rural households have access to safe drinking water.[1,2] Fifty-one percent of rural households do not practice any water purification method and the prevalence of diarrhea among children below three years of age is 25 percent.[2] Even in presence of access to safe drinking water at village level, morbidity and mortality due to diarrhea is still high.[2] Van Derslice and Briscoe found that in developing countries coliform levels (an indicator of contamination) were considerably higher in household water containers than in the original source water.[3] The practices like dipping a cup into the household drinking water container and use of earthen vessel for storage of drinking water were found to be associated with diarrhea.[4] Both these practices are common in rural Maharashtra. Simple, acceptable, low-cost interventions at household level were found capable of dramatically improving the microbial quality of drinking water stored in household and reducing risks of diarrheal diseases and death.[5] The present study was undertaken to evaluate the effect of faucet fitted to earthen vessel and/or sodium hypochlorite solution on diarrhea prevention at household level as a social intervention for diarrhea control under 'Community Led Initiatives for Child Survival (CLICS) program.

Materials and Methods:

Study area: The Kasturba Rural Health Training Centre (KRHTC), Anji (a peripheral centre of Mahatma Gandhi Institute of Medical Sciences, Sewagram [MGIMS] undertook present study in Wardha district of India (Maharashtra state) about 758 km east from the state capital Mumbai. About 60 percent of district population lives in rural area with 80 percent literacy.[1] Apart from the training and sensitization of medical undergraduates, nursing students, medical interns and post-graduate students to rural health problems, KRHTC run community based health care programs in surrounding 23 villages of Primary Health Centre, Anji with population of 31,482. Considering operational feasibility, out of these 23 villages, 10 villages were chosen for the present study having 4,518 households and population of 19,425.

Social mobilization: Since year 2003, USAID and Aga Khan Foundation sponsored Community-Led Initiatives for Child Survival (CLICS) program is being implemented in study area. The program aims to empower community to plan and act upon their priority health problems. Under social mobilization phase of program various community based organizations (CBOs) like women's self help groups; *Kishori Panchayat* (forum of adolescent girls) and *Kisan Vikas Manch* (Farmers' club) were formed in all villages. Village Coordination Committee (VCC) was a representative committee of above mentioned CBOs. VCCs were endorsed by village *Gram-panchayat* (local self government) for undertaking preventive and promotive health activities in each village. The VCCs were technically supported by KRHTC, Anji. The capacity of the VCC members to develop village health plan was built during their monthly village based meetings. In each village, the program selected CLICS *doot* (female village health worker) per 1000 population. She was supervised by VCC.

Social intervention: As per the priority of annual health plans of all villages, the diarrhea prevention activities were to be intensified during its peak transmission period i.e. monsoon period. As found in seasonal diagram with villagers, the peak occurrence of diarrhea was during the months of June and July. After triangulating the available research evidences and the findings of qualitative assessment of local people's drinking water storage and handling practices, we decided to evaluate the effect of use of hypochlorite solution bottles and faucet fitted earthen vessels as a measure to ensure safe drinking water at consumption point, presuming its safe storage. Considering the cost sensitive nature of rural people, the cost of fitting a plastic faucet to earthen vessel and that of a 50 ml, 4-6% hypochlorite solution bottle was fixed INR 15.0 each (US $ 0.3). The average earthen vessel used for water storage contains ten liters of water and two to three drops were sufficient to disinfect it.[6] In order to make both services acceptable and affordable to rural poor, the cost of services and its delivery at village level was decided in consensus with VCC members. The VCC members raised health funds from villagers and purchased plastic faucets and bottles of hypochlorite solution from a wholesale market and made it available at subsidized rates at village level. The intervention was promoted through the network of village level CBOs.

Capacity building: In April 2005, all VCC members were sensitized at KRHTC, Anji with focus on diarrhea prevention activities. Following this, the project staff skilled in fitting plastic faucet to earthen vessels, trained all CLICS *doots* from 10 villages. The training was skilled oriented and based on hands on experience of fitting a plastic faucet to earthen vessel. All VCCs purchased the required instruments to fit a plastic faucet to earthen vessel. A hole of appropriate bore was drilled in the earthen pot and a plastic faucet fitted with cement. To ensure good quality skills, the CLICS *doot* had to fit at least five faucets under supervision of program staff. In order to gain villagers faith, VCCs agreed to pay for any crack or damage to earthen vessels caused while fitting a faucet by CLICS *doot*. The CLICS *doot* were also trained in correct use of sodium hypochlorite solution.[6] In the month of May 2005, in monthly meetings of CBOs, the community organizers promoted these two methods. The CBO members were informed about the cost, potential benefits and service providers at village level. At the end of the monthly meeting s/he obtained the list of willing candidates, which was later communicated to CLICS *doot*. Later, CLICS *doot* paid home visits to enlisted potential clients and offered them the services. The decision to opt for a plastic faucet or a hypochlorite solution

bottle or both was finally taken by household women as they usually fetch water from public faucets and store it in house. Those women who accepted hypochlorite solution bottles, were explained the correct method of its use (2-3 drops of 4-6% sodium hypochlorite solution per 10 litres of water) in local language on each bottle. After providing the services at least three follow up visits were ensured by CLICS *doot* to ensure compliance with the use of intervention. The effect of the intervention was evaluated by community based unmatched case control study in 10 villages.

Selection of case and control households: In the month of May 2005**,** the program could mobilize 96 households with child under five years of age to use faucet fitted earthen vessel and 128 households with child under five years of age to use hypochlorite solution bottle (total of 224 households). All these households were taken as case households. One immediate neighborhood household with child under five years of age was chosen as control household for each case household. Out of 224 control households, we could obtain information for 213 (74%). The sample size was adequate (α=0.05 and ß=0.2) considering 25% prevalence of the diarrhea[2] and odds ratio of 2 as children from the families who did not use faucet were double at risk of diarrhea than those who used.[7]

In the last week of July 2005, a trained social worker interviewed household women using pre-designed and pre-tested questionnaire by paying house visits. The unit of data collection was households. A written informed consent was obtained from the respondents. An episode of diarrhea in a household was defined as any family member having 3 loose stools in a 24-hour period in last one month. Apart from this, socio-demographic information of the household was obtained. Questions were adopted from National Family Health Survey – II.[8] The color of the ration card was considered as an indicator of socio-economic status. Under public distribution system, Government of Maharashtra had distributed color coded ration cards to families depending on its socio-economic status. Yellow card signifies families below poverty line status. Those who attended school for at least one year were considered literate for the study purpose.

Data thus collected was analyzed in SPSS 12.0.1. Non parametric comparisons were made using *Chi*-square test between the two groups to check the differences in their composition in terms of source of water, caste, socio-economic status and education of housewife and head of the family. Unadjusted and adjusted odds ratio was calculated for assessing the effect of intervention on diarrhea. Population attributable risk proportion (PARP) for each intervention was calculated to estimate the effect at population level.

Results:

Total of 144 were case households and 213 control households were studied. Out of 144 case households, 96 used faucets fitted to earthen vessel and 128 used sodium hypochlorite solution There was no statistically significant difference between case households and the control households as respect to source of water, socio-economic status, caste and education of head of the family. But they differed significantly ($p<0.01$) in respect of education of housewife. (Table 1)

Table 1: Distribution of case and control households

Variables	Case households		Control households N(%)
	Households used Faucet fitted earthen vessel N(%)	Households used SH solution N(%)	
Source of DW			
Public Tap	46(47.9)	61(47.7)	113(53.1)
Hand pump	27(28.1)	41(32.0)	68(31.9)
Well	23(24.0)	26(20.3)	32(15.0)
Socio-economic status			
Bellow poverty line	25(26.0)	37(28.9)	57(26.8)
Above poverty line	71(74.0)	91(71.1)	156(73.2)
Caste			
SC/ST/DT/NT	19(19.8)	32(25.0)	58(27.2)
Other castes	77(80.2)	96(75.0)	155(72.8)
Education of housewife*			
Illiterate	13(13.5)	22(17.2)	66(31.0)
Literate	83(86.5)	106(82.8)	147(69.0)
Educaton of head of family			
Illiterate	17(17.7)	27(21.1)	53(24.9)
Literate	79(82.3)	101(78.9)	160(75.1)
Total	96(100.0)	128(100.0)	213(100.0)

*p<0.01 for all the categories when compared with control category

Odds ratio for households who used faucets fitted to earthen vessel was 0.49 (95% CI= 0.25 – 0.95). Odds ratio for households who used sodium hypochlorite solution was 0.55 (95% CI= 0.31 – 0.98). About 27 percent of diarrhea cases could have been prevented at community level if faucet fitted earthen vessel were used or 22 percent of diarrhea cases could have been prevented if sodium hypochlorite solution was used (population attributable risk proportion of 0.27 and 0.22 respectively) (Table 2).

Table 2: Effect of faucet fitted to earthen vessel, use of sodium hypochlorite solution at household level

Intervention group	Households with diarrhea N (%)	OR (95% CI)		PARP** (95% CI)
		Unadjusted	Adjusted*	
Control households	57/213(26.8)	-	-	-
Households used faucet fitted earthen vessel	13/96 (13.5)	0.43(0.22-0.82)	0.49(0.25-0.95)	0.27(0.01-0.79)
Households used hypochlorite Solution	20/128(15.6)	0.51(0.29-0.89)	0.55(0.31-0.98)	0.22(0.01-0.59)

*Adjusted for caste, socio-economic status, education of housewife and head of family and source of water
**Population Attributable Risk Proportion

Discussion:

In rural India, the supply of drinking water at village level is a responsibility of village *Gram Panchayat* (local self-governing body). The water from nearby reservoirs is drawn into a tank where it is chlorinated by a '*Chaprasi*' (a functionary appointed by the *Gram Panchayat*) and finally water is distributed to public faucets in the village. Mistry et al pointed out that due to frequent electrical failures in rural area; water reaching the tank is irregular.[9] Adequate chlorination is frequently aborted due to immediate requirement of water or done in haste rendering the water undrinkable. There was daily eight hours electric power cut in the study area. Additionally, the practice of storing drinking water in earthen vessel was common in the area. Mahmud et al reported an association between persistent diarrhea among infants in rural Egypt and drinking water storage in earthen vessel.[10] Tuttle et al in Zambia found that diarrhea was associated with dipping a cup into the household drinking water container.[4] This practice was almost universal in study area.

Odds ratio for households who used faucets fitted to earthen vessel and hypochlorite solution bottles 0.49 and 0.55 respectively. The household women required motivation and counseling for accepting the use of plastic faucet as they were apprehensive about possible damage to their earthen vessels. It is to be noted that unlike for use of hypochlorite solution, a faucet once fitted required little check on compliance of rural women as it was a one time activity. The objective verification of daily correct use of hypochlorite solution was little difficult. We resorted to self reported compliance of use of sodium hypochlorite solution.

In the present study, households who used faucet fitted earthen vessel for storing drinking water or sodium hypochlorite solution had moderate protection from diarrhea. Yeager et al also reported low risk of diarrhea in households where water was stored in container with faucet.[7] Gilbert had promoted Sûr'Eau (solution of 0.4% sodium hypochlorite in a 500 ml bottle) through social marketing for prevention of diarrhea in Madagaskar and found effective in reducing risk of diarrhea at little cost i.e. 2,000 Malagasy francs (34 cents) per month.[11] Thomas et al promoted ceramic water filters for treating drinking water at the household level in rural Bolivia.[12] The cost of the vessels, valves, and fabrication (drilling holes) was approximately U.S. $ 7.50. Noteworthy, the approach of the present people centered diarrhea control program was highly participatory and culture sensitive. In the present study, the trained village based female health workers i.e. CLICS *doots* provided services through the existing network of community based groups at a cost of INR.15.0 (US $ 0.3). A minimal instruments and skill was required to fit a faucet to an earthen vessel. Like in other developing countries, people in the study area were also willing to pay for these water purification methods.

In present study, the intervention strategy empowered community to plan and act on diarrhea problem. It focused on household as a unit of change. Blum et al in Nigeria ensured community participation for safe drinking water supply and sanitation project.[13] The need to shift the focus of diarrheal disease control strategies in India from oral rehydration and rational drug therapy to more social and community oriented strategies where people become the centre of action to solve the problem has been increasingly felt. In India, programs like National Rural Health Mission and Reproductive and Child Health Program also emphasize active community participation in health programs for ensuring success.[14,15] The present study findings also demonstrated the effect of community participation in a health program. Finally, the limitation of the present study was that the history of diarrhea episodes in the household was based on the recall of the women respondents.

To summarize, even safe drinking water is available and accessible to rural households of Maharashtra state, cul-

tural and traditional practices potentially contaminate it at consumption point. To ensure safe drinking water at household level, the effective and cheap methods like fitting faucet to traditionally used earthen vessel and/or use of sodium hypochlorite solution must be promoted through community at household level for cost and culture sensitive rural people in India.

Acknowledgements:
We acknowledge the financial assistance from Aga Khan Foundation and USAID under Child Survival Grant with the cooperative agreement GHS-A-00-03-00015-00.

Contribution by authors:
All three authors contributed to design of the study. First author wrote introduction part, methodology and the discussion, second author analyzed the data and wrote results section while third author critically revised the manuscript. All three authors were involved in study design.

Conflict of interest:
Authors declare no conflict of interest.

References:

1. Registrar General of India. Census of India 2001 [Cited 2006 January 15]. Available from URL: http://www.censusindia.net/data/mah.pdf
2. National Family Health Survey (NFHS-2): Nutrition and the prevalence of anaemia. Mumbai: International Institute for Population Sciences and ORC Macro; 1999
3. VanDerslice J, Briscoe J. All coliforms are not created equal: A comparison of the effects of water source and in-house water contamination on infantile diarrheal disease. *Wat. Resour. Res.* 1993;29:1983-1985.
4. Tuttle J, Ries AA, Chimba RM, Perera CU, Bean NH, Griffin PM. Antimicrobial resistant epidemic Shigella dysenteriae Type 1 in Zambia: modes of transmission. *J. Infect. Dis.* 1995;171:371-375.
5. World Health Organization. Improving water and sanitation hygiene behaviours for the reduction of diarrhoeal disease: the report of an informal consultation. CWS/CDD programmes, Geneva: World Health Organization; 1993
6. National Institute of Communicable Diseases. Chlorination of drinking water. [Cited 2005 January 15]. Available from URL: http://nicd.org/Cholera.asp
7. Yeager BAC, Lanata CF, Lazo F, Verastegui H, Black RE. Transmission factors and socio-economic status as determinants of diarrheal incidence in Lima, Peru. *J. Diarrhoeal Dis. Res.* 1991;9:186-193.
8. National Family Health Survey, India 1998-1999. [Cited 2005 January 15]. Available from URL: http://www.nfhsindia.org/pdf/Woman_QRE.pdf
9. Mistry NF, Birdi TJ, Antia NH. Community aspects of diarrhoeal disease control In Diarrhoeal Diseases: Current Status, Research Trends and Field Studies-Proceedings of The Third Sir Dorabji Tata Symposium. Raghunath D, Nayak R. (ed.). Tata McGraw Hill Publishing Co.Ltd. 2003: 305-311
10. Mahmud MA, Hossain MM, Huang DB, Habib M, DuPont HL. Sociodemographic, environmental and clinical risk factors for developing persistent diarrhea among infants in a rural community of Egypt. *J. Health Popul. Nutr.* 2001;19(4):313-319.
11. Gilbert N. Mobilizing Madagascar households to disinfect their drinking water. WATERfront, Issue 16. UNICEF; 2003
12. Thomas F, Clasen Brown J, Collin S, Suntura O, Cairncross S. Reducing diarrhea through the use of household based ceramic water filters: A randomized, controlled trial in rural Bolivia. *Am. J. Trop. Med. Hyg.*, 2004:70(6);651-657.
13. Blum D, Emeh RN, Huttly SR, Dosunmu-Ogunbi O, Okeke N, Ajala M, Okoro JI, Akujobi C, Kirkwood BR, Feachem RG. The Imo State (Nigeria) Drinking Water Supply and Sanitation Project, 1. Description of the project, evaluation methods, and impact on intervening variables. *Transactions of the Royal Society of Tropical Medicine & Hygiene* 1990;84(2):309-315.
14. Government of India. National Rural Health Mission. [Cited 2006 February 12]. Available from URL: http://www.mohfw.nic.in/NRHM%20Mission%20Document.pdf
15. Government of India. Reproductive and Child Health Programme - II. New Delhi: Government of India; 2004